

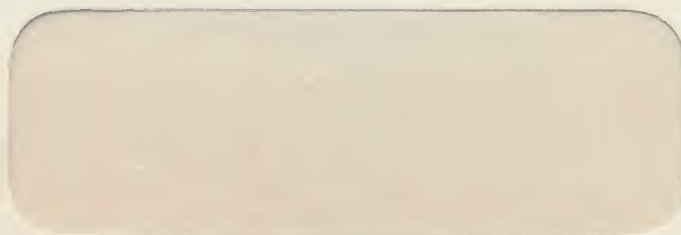
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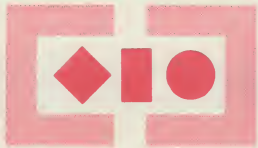
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July, 1967

Dear Member:

During the past ten years it has become meaningless to speak of "a modern computer," so great has been the pace of development. Computers have enjoyed a rapid proliferation for three reasons: the truly explosive growth of their data capacity and speeds; their immense diversity of uses; and the great advances that have been made in man-machine communication.

One result of the need for man-machine communication has been the development of so-called "programming languages," which permit the use of computers by people who understand the nature of a problem but who may not necessarily be versed in the details of computers or even of mathematics.

Man-machine communication has placed an increasing accent upon a relatively new field, called communication theory--a term that is also synonymous with information theory.

This month's Main Selection

ON HUMAN COMMUNICATION

by Colin Cherry

is a comprehensive exploration of the entire field of communication, with the accent on the mathematical theory of communication. (In any technical system, the component which is most important is information capacity, and this may be defined strictly on a mathematical basis.)

Now in a second, revised and completely updated edition, ON HUMAN COMMUNICATION would be distinguished if for no other reason than that it is one of the first attempts to survey every aspect of communication theory. The author, who is Professor of Telecommunication at Imperial College of the University of London, has drawn from many fields to demonstrate the many-sided nature of communication theory--mathematics, physics, linguistics, phonetics, psychology, to name but a few. The result is a work of amazing diversity.

ON HUMAN COMMUNICATION is organized into seven self-contained but unified chapters. Professor Cherry begins, in "Communication and Organization," with an analysis of the basic question, "What is communication?" The next chapter
(continued on back page)

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ON HUMAN COMMUNICATION

by Colin Cherry

a comprehensive exploration of the entire field of communication, with the accent on the *mathematical*

Here is a handbook that represents one of the first attempts to survey every aspect of communication theory. (The author, Colin Cherry, will be instantly recognized by specialists in the field of communications for his applications of Bayes' theorem.)

In seven highly lucid chapters, Dr. Cherry manages to concentrate and to communicate an impressive array of facts and information from such fields as linguistics, physics, psychology, acoustics, semantics, and the theory of signs. Hence, *ON HUMAN COMMUNICATION* is not only for information specialists who may wish to become better acquainted with this new field of communication studies—and what their colleagues in it are doing—it is also for anyone in the computer sciences who may simply wish to get his bearings in this rapidly changing new area.

What the Critics Say:

"What an assemblage of fact and speculation! . . . ranging from Helmholtz on tones to Lewin on topological psychology to Whittaker on interpolatory function theory to Wittgenstein on logic; from Shannon on communication to Zipf on behavior and least effort to Toynbee on history to Jakobson on phonemics. There is a constant tug-of-war between presenting the logical product of these fields and presenting their logical sum . . . Withal, a fascinating and stimulating book."

—P. J. Davis of the National Bureau of Standards in *Physics Today*.

"The design of the study is admirable, and the execution is superb. Moreover, the book itself is, indeed, a model of human communication."

—Arthur L. Beely of the University of Utah in *Science*.

"Can be valuable to technical men who know less about communication theory than they should. They will be safe in Mr. Cherry's hands, and he does a very good best to make a great many important things simple and understandable."

—John R. Pierce of Bell Telephone Laboratories in the *Proceedings of the I.R.E.*

CONTI

Chapter 1 Communication and Organization— an Essay

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- 2 What Is "Communication"?
- 3 What Is It That We Communicate?
- 4 Some Difficulties of Description of Human Communication
- 5 Co-operative and Non-co-operative Links
- 6 Communication and Social Pattern
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 - 6.2 Social Fields and Networks
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ON HUMAN COMMUN

by Colin Cherry

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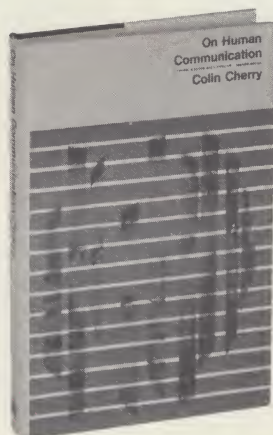
ical theory of communication

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- 7 On the Brain as a "Machine"

ICATION

Bonus Book



Alternate Selection

ELECTRONIC INFORMATION HANDLING

Edited by Allen Kent

Director, Knowledge Availability Systems Center
University of Pittsburgh

and Orrin E. Taulbee

Manager, Information Sciences
Goodyear Aerospace Corporation

The *information explosion*, as the incredibly growing availability of data is termed, must not only be controlled but also needs to have its effects directed. Information handling by electronic means is the only feasible way to supply this direction, especially when the goal is to provide the means for making decisions.

To study the problems of information handling, authorities from education, industry and government were brought together at a national conference in the Fall of 1964. Jointly sponsored by the University of Pittsburgh, Western Michigan University, and the Goodyear Aerospace Corporation, the meeting dealt with processing methodology in areas ranging from library science to military command and control.

The papers presented were organized into six sessions as follows:

- Analysis of the field
- End uses of information
- Operational experiences
- Large-scale systems under development
- Shortcomings of electronic information-handling systems
- Planning for the future

The common thread running through the conference revolved about explorations of the field of information processing in support of decision-making requirements—decision-making at various levels, in various environments, and for various purposes.

Alternate Selection:

ELECTRONIC INFORMATION HANDLING

Edited by

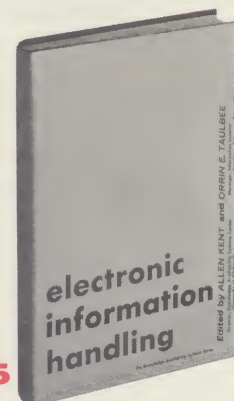
Allen Kent and Orrin E. Taulbee

355 pages

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is an historical review of the evolution of communication science, which touches briefly on R.V.L. Hartley's pioneering mathematical theory of communication. In Chapter Three, "On Signs, Language, and Communication," the author then explores linguistics, phonetics, and "the meaning of meaning."

Chapter Four opens up the world of the telecommunication engineer, with a description of physical signals--especially speech--and how they are analyzed mathematically to determine their wave forms and spectra. This is considered separately from the quantitative measurement of the information itself, a problem which is discussed in the section that follows.

Entitled "On the Statistical Theory of Communication," this section is a more detailed and marvelously lucid presentation of Hartley's theory (first published in the Bell System Technical Journal in 1928), regarded as the groundwork for the modern theory of communication as later modified by Norbert Wiener, Claude E. Shannon and Warren Weaver. Hartley defined "information" as logical "instructions to select" and designated a logarithmic measure of information rate. Among the other topics treated in this highly informative chapter are the uses of prior information and redundancy, "continuous" information, communication when random electrical noise is present, the ultimate capacity of a noisy channel, and information interpreted as entropy.

Chapter Six is an important study of the logic of communication (syntactics, semantics, and pragmatics)--important because communication must be founded upon logic as well as upon mathematics.

Professor Cherry, in the final chapter, "On Cognition and Recognition," covers such diverse topics in the psychology of communication as the intake of information by the senses, pattern recognition, and the human brain as a "machine." Although he recognizes the importance of studies in the "behaviorism of machines," it is interesting to note that the author has little patience with those who would compare the human brain to a computer. "The brain may contain more than 10^{10} nerve cells, whereas the most complicated computing machine may have up to a million switches, so how can they possibly be compared?" asks Professor Cherry.

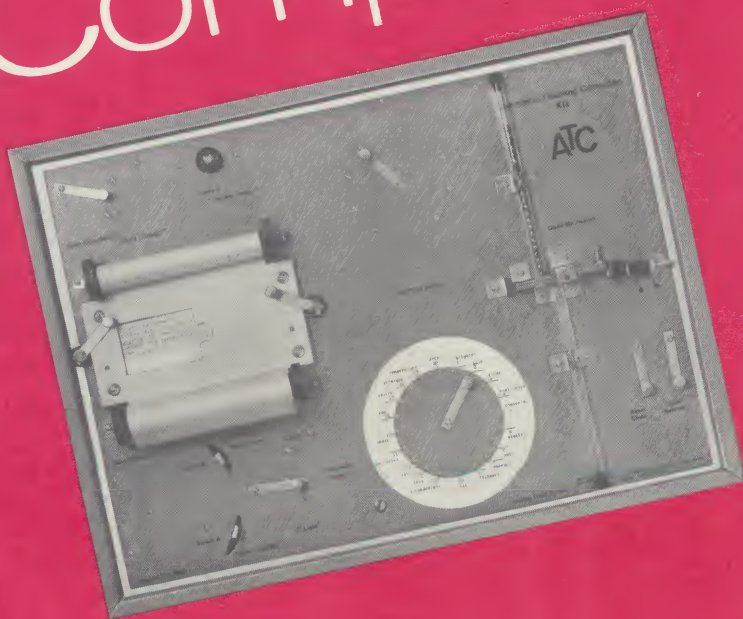
Communication theory, or information theory, is a relatively "new" science that overlaps into many other fields. Colin Cherry's book, ON HUMAN COMMUNICATION, is an ambitious yet very successful attempt to delineate its amazingly broad multidisciplinary character, as well as to provide the reader with abundant food for thought. No one who is concerned with any aspect of information in the computer sciences can afford to miss this remarkable work.

Sincerely yours,

Martin Reynolds

Martin Reynolds
Executive Director

The Automatic Teaching Computer



Teaching machines and programmed instruction are new methods of education that have attracted a considerable amount of interest in the past few years. These "new" methods actually represent a collection of psychologically sound teaching principles that have been known for some time. Their unique characteristics lie in their coordinated application, which provides new insights into the teaching and learning process. In addition, the amazing powers of today's computers are affecting much that can be done with teaching machines.

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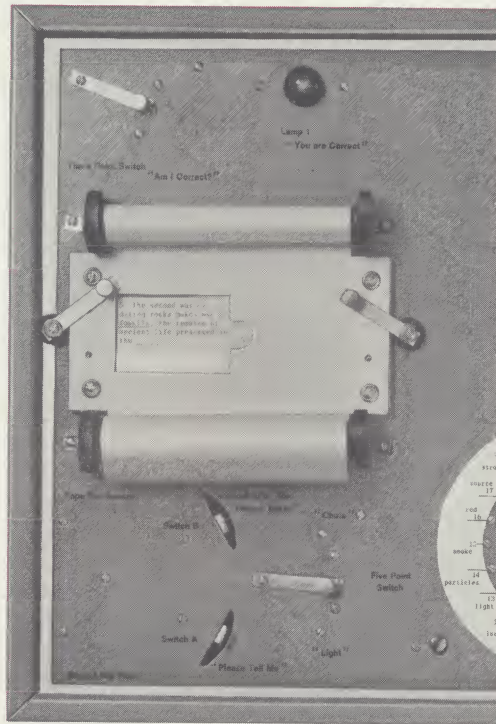
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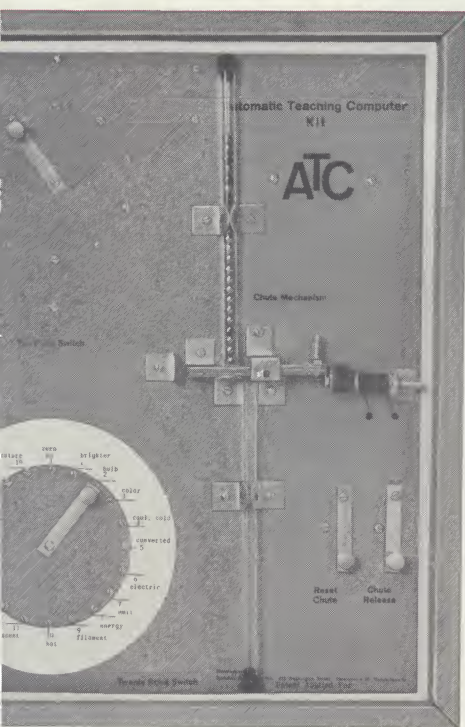
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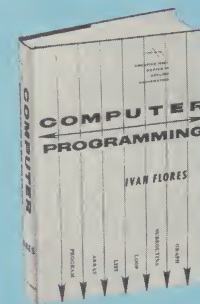
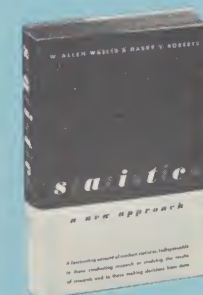
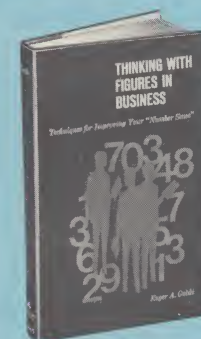
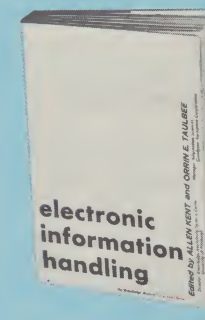
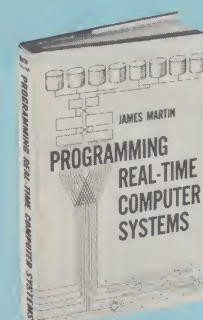
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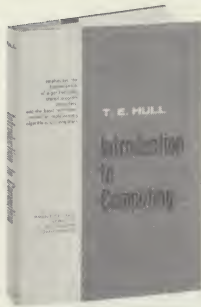
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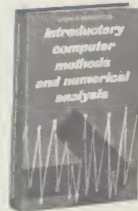
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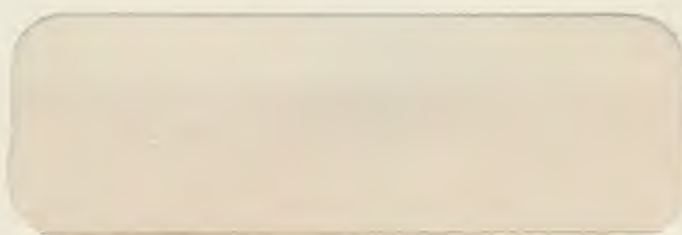
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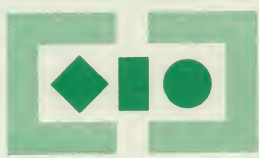
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Dear Member:

The advent of the high-speed computer has revolutionized the art of computation. Computer designers have learned, however, that it is much more difficult to explain to a machine how a problem is to be solved than it is to explain it to most people. Similarly, the process that is easiest for a human to carry out is not necessarily the easiest or the most accurate when performed by the machine.

This month's Main Selection

BRIEF NUMERICAL METHODS

by Wendell E. Grove

is a book about mathematics. The word "computer" does not appear in the title; you will not find any details about computers in it, nor will you learn a computer language. You will, however, be introduced to a fascinating and useful branch of computer-oriented mathematics--numerical methods--which is concerned with solving difficult problems--not the stylized and sometimes useless problems found in most mathematics books.

This is an unusual and different kind of mathematics--mathematics which is almost never taught in standard math courses. Yet the sincerest tribute to the applicability of numerical methods lies in the fact that this book originated as the text for a course taught by the author at the General Motors Institute in Flint, Michigan.

Numerical methods is, by definition, that branch of mathematics concerned with developing and evaluating techniques for employing computers to solve problems. Most day-to-day computing is done by little more than intuition and trial and error. BRIEF NUMERICAL METHODS goes a long way toward bridging the gap between science and artistry in computing--even though this gap may never be closed completely. Using this concise and practical volume, you will be able to establish methods for obtaining answers and ascertaining their accuracy. With proficiency in this branch of computing science, you will then be able to rely on the accuracy of your computations and to determine whether your results are meaningful.

The solution of some equations may be obtained by direct, or "closed," methods that produce an exact answer after a finite number of operations. However, so-called direct methods may not be the most desirable for computer calculations because of round-off errors, truncation errors, or the unforeseen propagation of inherited errors that often compound themselves with disastrous consequences.

(continued on back page)

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BRIEF NUMERICAL METHODS

by Wendell E. Grove

an introduction to elementary numerical methods, emphasizing iterative solutions

"The growth of the use of digital computers in all aspects of science and engineering requires . . . a knowledge of the impact of digital computers . . . [in these fields]. The material presented in the following pages is an attempt to acquaint students of these disciplines with some of the elementary numerical methods found useful in the field of computing." *—from the author's Preface*

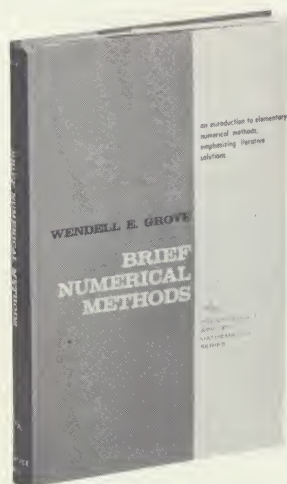
This new book covers iterative solution of equations (both single and simultaneous non-linear equations), interpolation versus curve fitting (as attempts to accomplish the same purpose), numerical integration and solution of ordinary differential equations. The problems are especially selected to help point out the usefulness of the techniques involved.

Features:

Includes numerous examples with solutions
Offers computer-oriented problems—many of which cannot be handled by other techniques
Presents a number of flow charts
Contains more information on iterative methods for the solution of equations than many other books in the field

About the Author:

Wendell E. Grove, Associate Professor of Mathematics, General Motors Institute, Flint, Michigan, has taught FORTRAN, machine language, symbolic language, and GE Basic to both undergraduate and graduate engineers.



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by Wendell E. Grove
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Contents

1. **Iterative Solution of Algebraic and Transcendental Equations**
A process for square root
The iterative form $x = f(x)$
Order of iteration
Simple iteration flow chart
The Newton-Raphson method
Criteria for ending the iteration
Aitken's delta squared process
Rule of false position or regula falsi
Secant method
Interval halving or bisection
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Complex roots by the Newton-Raphson method
Lin's method for complex roots of algebraic equations
3. **Simultaneous Equations**
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The Newton-Raphson method for simultaneous equations
The method of steepest descent
The Wegstein method for two functions of two variables
The Wegstein method for three equations in three unknowns
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Forward differences
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Linear interpolation
Differences and polynomials
The operators E and Δ
Newton's backward interpolation formula
Aitken's repeated process
Inverse interpolation
5. **Curve Fitting**
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Flow diagram for least-squares curve fit
What type of curve to fit
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Simultaneous equations
Nystrom scheme for second-order (initial-value) equations
Fourth-order equations
8. **A Simple Boundary-Value Problem**
Difference equations

DIGITAL TAPE DRIVES

DATA FREEWAYS INTO COMPUTERS

by James E. Taunt

Little information has been written or published on the mechanism of digital tape drives. Yet an electronic computer with a malfunctioning tape transport is just as dead as an automobile with a clogged fuel line. In an effort to overcome the shortage of information on tape drives, James E. Taunt, a highly qualified systems-engineer on the staff of the General Electric Company's computer department in Phoenix, Arizona, has written this new book as a concise non-technical explanation for computer programmers, analysts, managers and consultants. Chapters include all the various aspects of digital tape drives: reels, buffer storage, capstans, head guides, electronics, operator controls and human factors.

Through careful, incisive description of the inner workings of a digital tape drive, the author provides a clear picture of this computer room little "beast of burden". This information is particularly useful when investigating an unknown computer system, when trying to increase the efficiency of an existing computer system, or when planning for increased capacity.

The basic knowledge offered about design compromises can aid the user in specifying more exactly the equipment that fits his needs in the data communication and recording field. Moreover, the information given is sufficiently detailed so that those who are entering the computer design field will gain a clear understanding of what is necessary for good computer design.

Alternate Selection

DIGITAL TAPE DRIVES

Data Freeways
into Computers

by James E. Taunt

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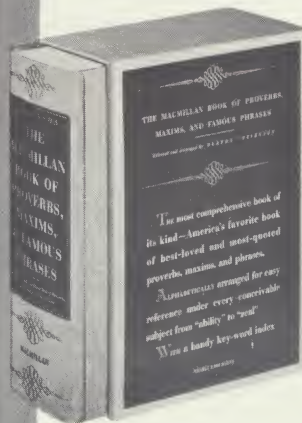
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One of the most useful aspects of this volume is its extraordinarily complete Index. Every proverb, maxim, and saying is listed by at least one key word, and often by more than one. Any entry may be immediately located by page number, and every subject heading is cross-indexed where applicable, so that the phrase that is now only "on the tip of your tongue" can be at your fingertips in moments.

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Another approach is an approximation technique which uses a starting guess and successively improves upon it with a repetition of similar steps--the iterative, or "open," methods explored in detail in BRIEF NUMERICAL METHODS. Iterative techniques are particularly useful in programming digital computers for two very important reasons:

* Use of the same set of instructions repetitively saves space in the computer's memory, and

* Round-off errors are minimized (whereas in so-called direct methods they tend to compound themselves).

The most unusual feature of a digital computer is, of course, its tremendous speed--but careful planning is also required to make the most of this speed. Part of this planning lies in having a good starting point. Another part has to do with arranging the computation to take advantage of the feature of repetition.

BRIEF NUMERICAL METHODS presents the fundamentals of the use of interactive techniques in computing in six compactly informative chapters:

* Iterative solution of algebraic and transcendental equations, including an iterative technique for finding the square root of a positive real number;

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* Simultaneous equations, which are much more difficult to solve than single equations;

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BRIEF NUMERICAL METHODS offers flow charts, computer-oriented problems (many of which cannot be handled by other techniques), and numerous examples in the text (with solutions in detail). Although many of the problems in this concise volume can be performed with a hand or desk calculator, readers may find that a computer with an algebraic compiler such as FORTRAN is more desirable.

Computer-oriented mathematics is still in its infancy and many new methods especially suited to computers are being developed. Let BRIEF NUMERICAL METHODS open up this utilitarian field for you!

Sincerely yours,

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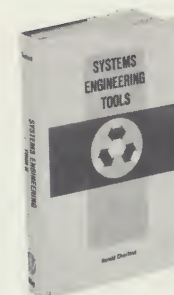
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Ape	<i>See also inheritance</i>	Self
Architecture	Itch	[<i>Self-Accusation,</i>
Bachelor	Knowledge	<i>Self-Betrayal, Self-</i>
<i>See also Celibacy</i>	<i>See also Learning;</i>	<i>Control, Self-Denial,</i>
Brain	<i>Self Knowledge;</i>	<i>Self-Interest, Self-</i>
<i>See also Mind</i>	<i>Wisdom</i>	<i>Judgment, Self-Love,</i>
Chance	Justice	<i>Self-Preservation,</i>
<i>See also Accident,</i>	Kiss & Kissing	<i>Self-Respect]</i>
<i>Fortune, Gambling,</i>	Life	Silence
<i>Hap, Luck</i>	Love	Spending
Compensation	Man	Star
<i>See also Sweet and Sour</i>	<i>See also Humanity</i>	Taxes
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Fate	Orpheus	War
<i>See also Destiny,</i>	Patience	Wife
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Government	Perseverance	<i>and Wife</i>
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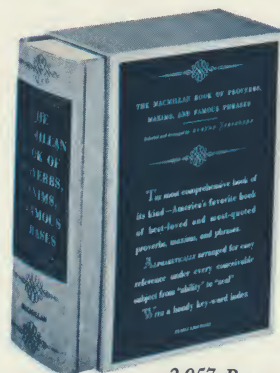
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